Highly Available Atomic Consistency

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High Performance Transaction Systems
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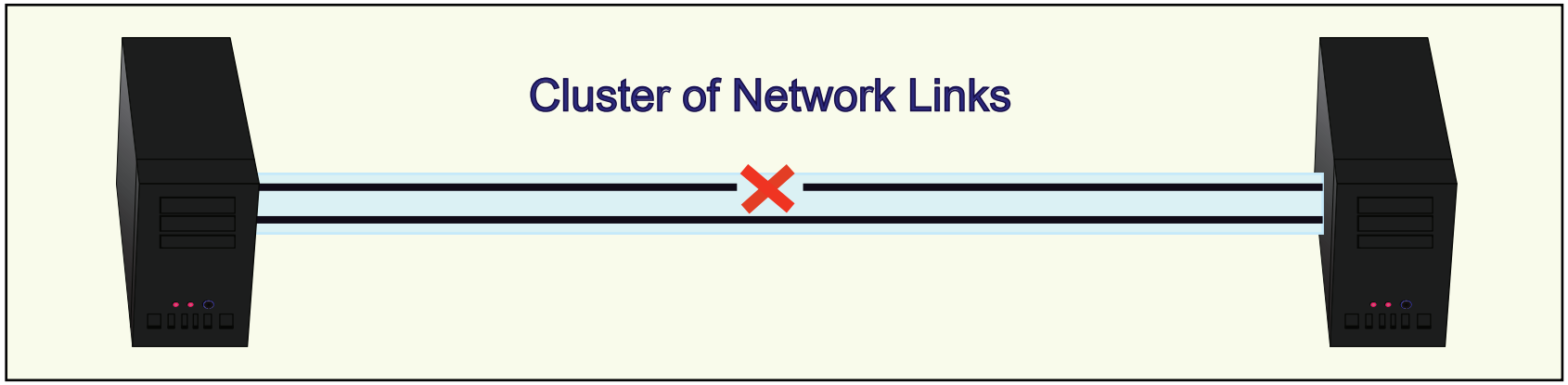
How We Built a Data System where:

- CAP theorem is Inapplicable
- Distributed Transactions Do Not Block
- Synchronous Replication brings No Additional Latency
- Multi Partition Transactions Outperform Local Ones

Clustered Network Links

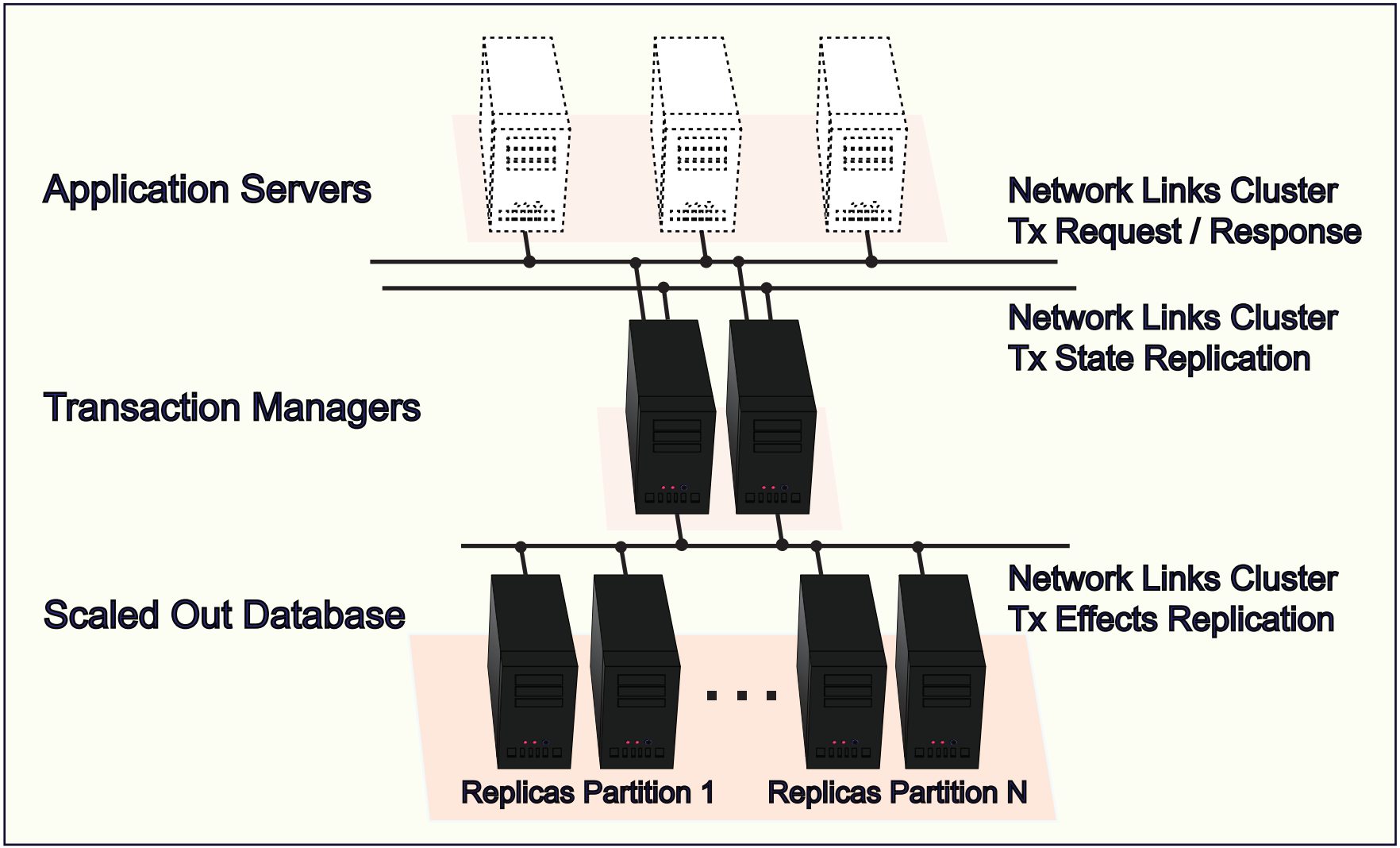
- CAP Theorem to Apply: A Faulty Network Link Partitions the System
- To Bypass the Theorem: Prevention of System Partitioning is Sufficient



Our Clustering Solution:

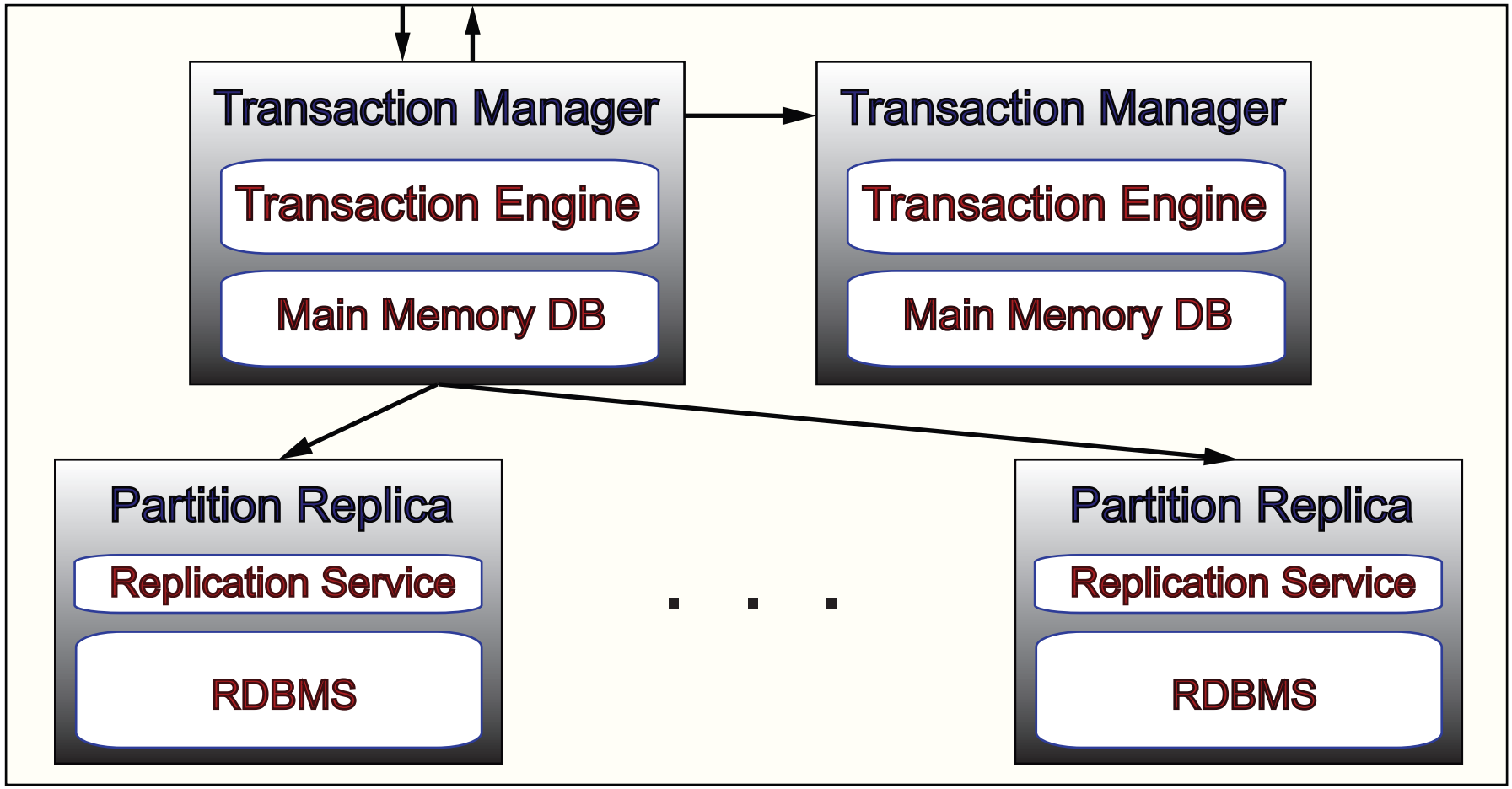
- Integrates Redundant Capacity
- Prevents Lost or Delayed Messages
- Guarantees Ordered Delivery

System Architecture



Architecture of Transactions

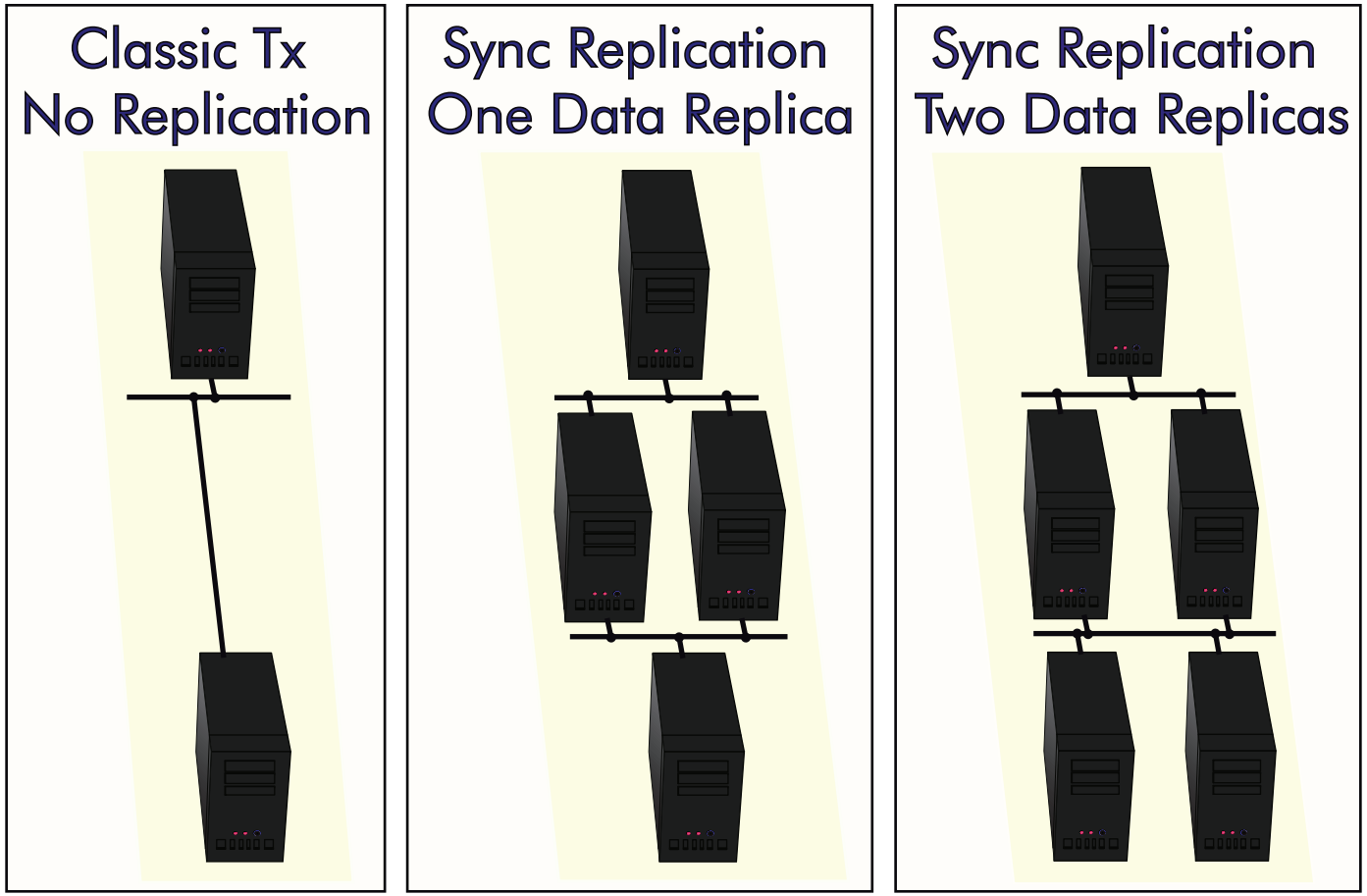
- 'Writes' executed on All Transaction Managers
- Against their own Main Memory Copy of the database
- Effects of 'Writes' applied on Multiple Replicas



Synchronous Linearizable Replication

Performance Evaluation

TPC-C benchmark New-Order transactions with 10 items on 3 different systems:



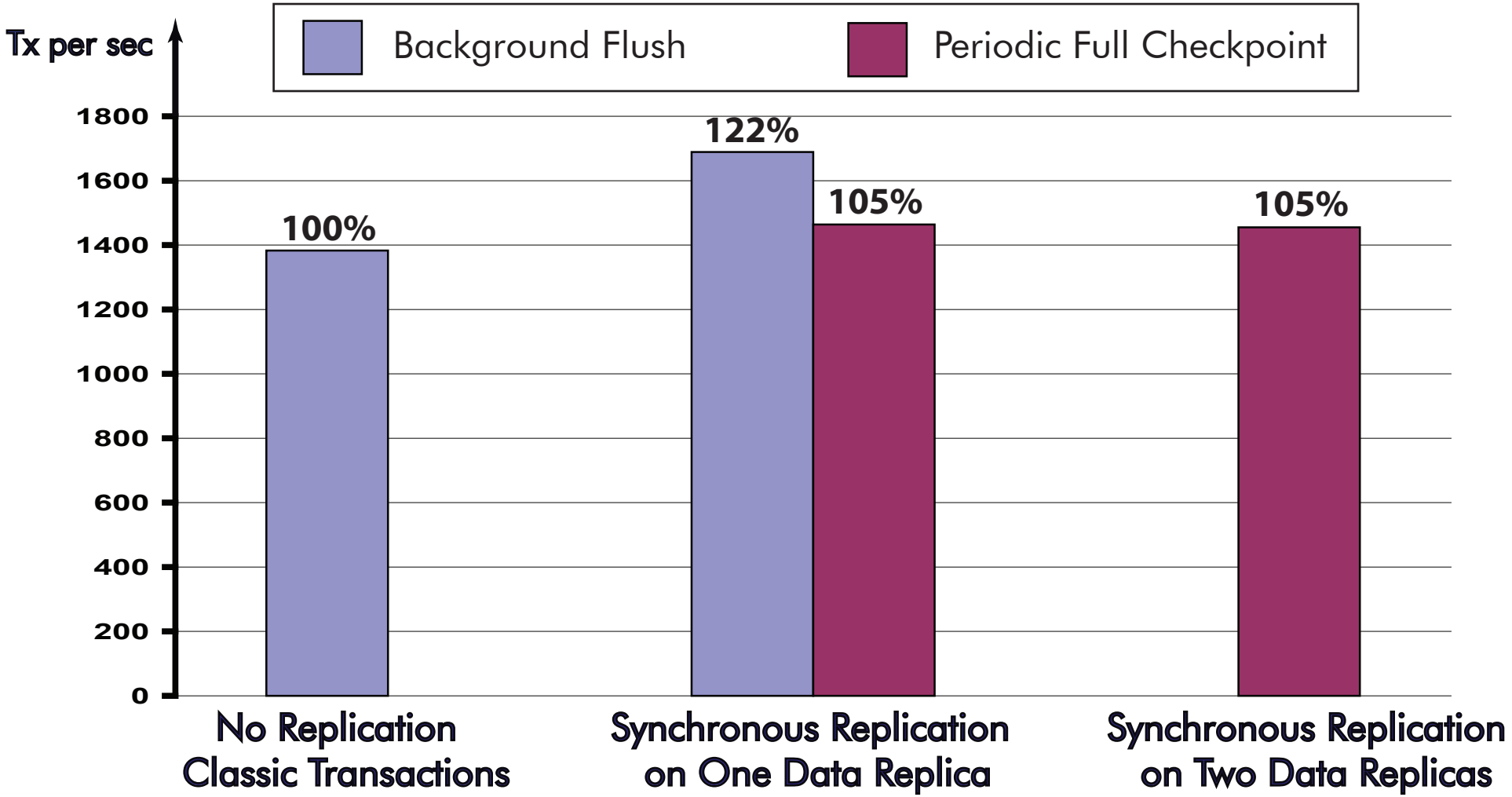
Application Server
Machine under $500

Transaction Management
Machines under $1,500

Data Management
Machines under $500
running MS SQL

Synchronous Linearizable Replication

Result: No Added Latency

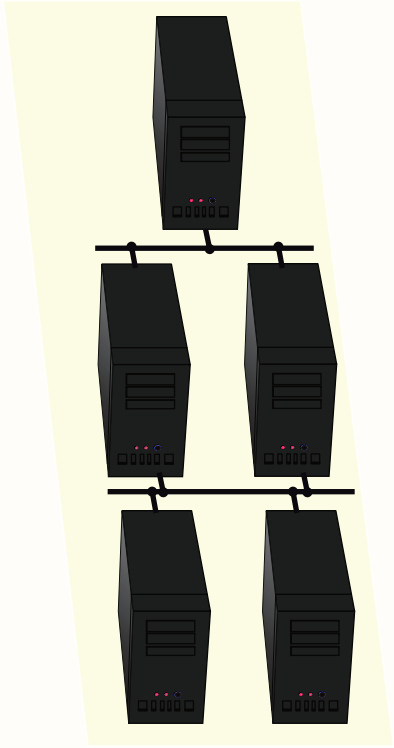


Multi Partition Transactions

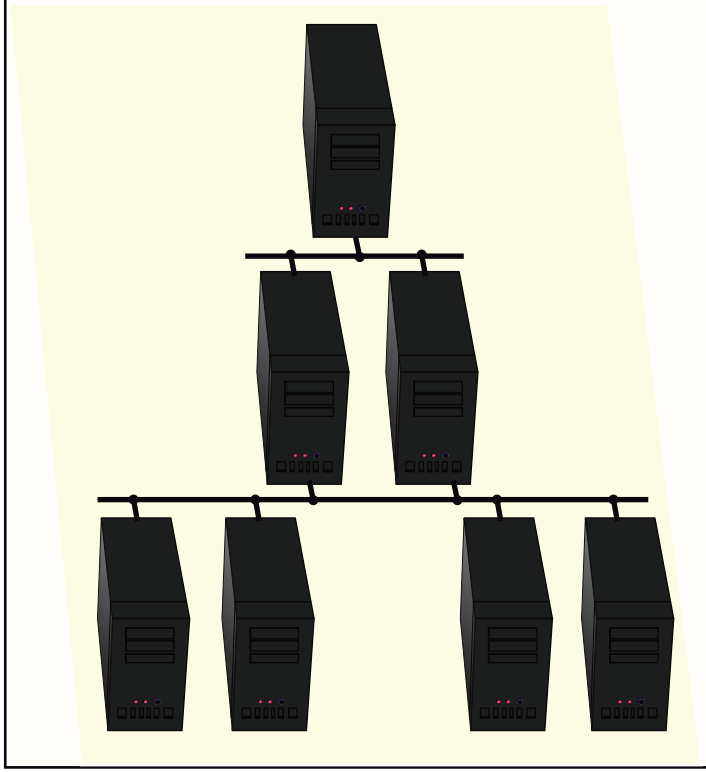
Performance Evaluation

2 Partitions, TPC-C benchmark New-Order transactions with 5 items from each Partition

Single Partition Transactions

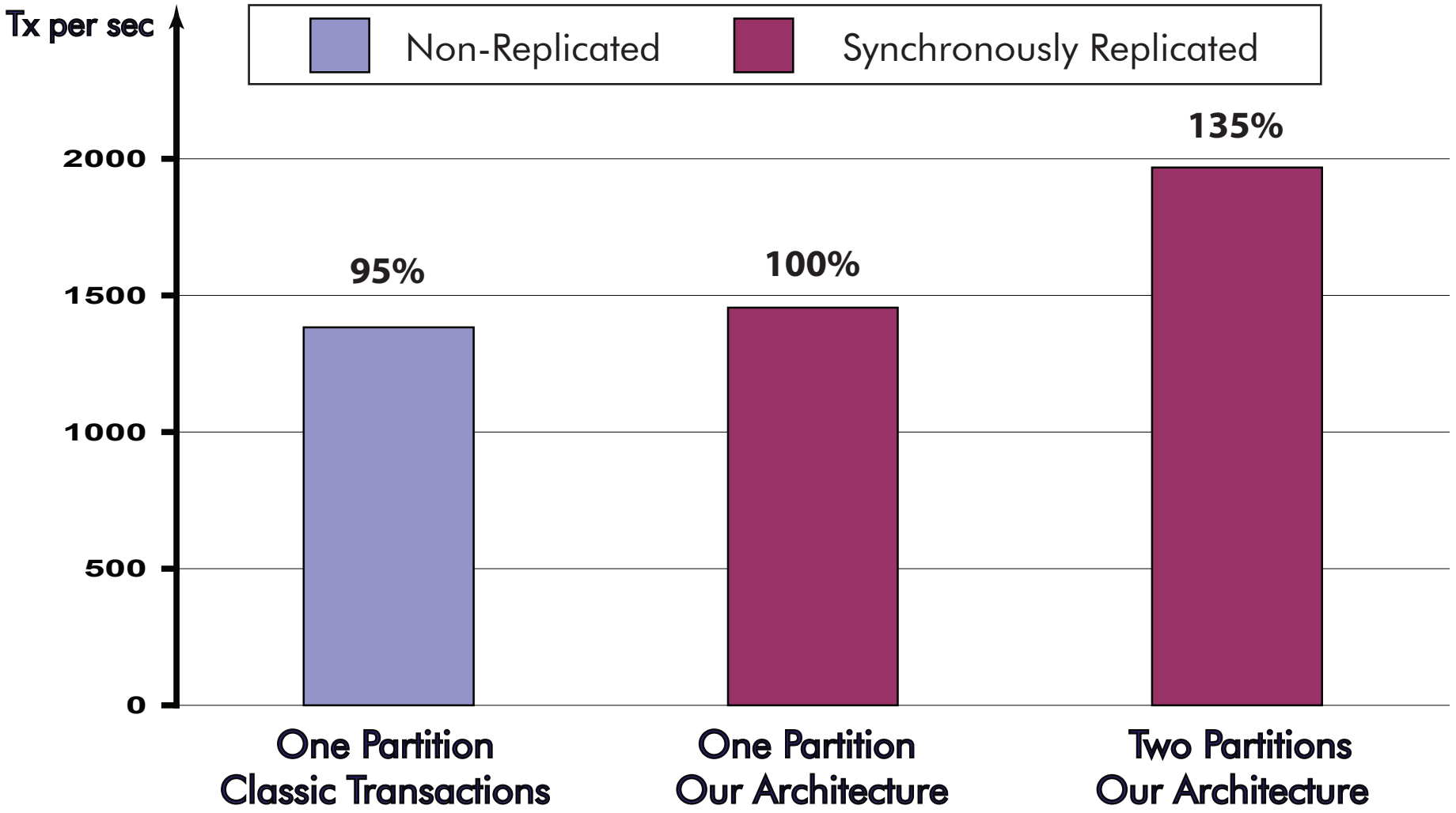


Two Partition Transactions, Two Replicas per Partition



Multi Partition Transactions

Result: Higher Throughput



Conclusion

The presented Transactional Architecture guarantees

Atomic Consistency of Replicas
High Availability of Transactions
Higher Throughput with Multi Partition Transactions

Thank You

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